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RESEARCH ARTICLE **Open Access**

The aspect of nationality in participation and performance at the 'Powerman Duathlon World Championship' – The 'Powerman Zofingen' from 2002 to 2011

Christoph A Rüst[1]✉, Beat Knechtle[2], Patrizia Knechtle[2], Thomas Rosemann[1], Romuald Lepers[3]

Abstract

We investigated participation and performance trends in duathletes in the 'Powerman Duathlon World Championship' in Zofingen, Switzerland, from 2002 to 2011, regarding the nationality of the finishers. Sex and nationality at the time of the competition and overall race times of both women and men finishers at the 'Powerman Zofingen' (10 km run, 150 km cycle, 30 km run) were analysed from 2002 to 2011 using linear regression analysis. In total, 272 women and 1,964 men finished the race. Participation increased across years in women (r^2=0.73, P<0.01), but not in men (r^2=0.15, P>0.05). Most of the athletes originated from Switzerland, followed by participants from Germany, France, Italy, Belgium, the United States of America, Spain, Great Britain, the Netherlands and Denmark. Across the years, both German men (r^2=0.55, P=0.01) and German women (r^2=0.66, P<0.01) increased their participation. The top five athletes overall showed no changes in performance for both women and men where Swiss athletes achieved the fastest race times. Athletes from the five countries with the highest participation showed no changes in overall race time. To summarize, (i) European athletes from Switzerland and Germany dominated participation in the 'Powerman World Championship' where Swiss duathletes were the fastest and (ii) duathletes at world-class level showed no changes in performance in the last ten years. Future studies should investigate the participation and performance trends in other long distance duathlons of the 'Powerman World Series'.

Keywords: running, cycling, ultra, endurance, multi-sport

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Introduction

In endurance sports, the dominance of athletes originating from a specific country or ethnic group is a well-known phenomenon (Babel et al. 2005; Lucia et al. 2006; Onywera 2009; Onywera et al. 2006; Trewin et al. 2004). For running, since the 1968 Mexico City Olympics, Kenyan and Ethiopian runners have dominated the middle- and long-distance events in athletics and have exhibited comparable dominance in international cross-country and road-racing competition (Wilber & Pitsiladis, 2012). Kenyan runners dominate running distances from 800 m to the marathon (Onywera et al. 2006). The top Kenyan runners seem to arise from a specific region or ethnic group in Kenya. Most national and international athletes originate from the Rift Valley province and belong to the Kalenjin ethnic group and Nandi sub-tribe (Onywera et al. 2006). Apart from running, ethnicity might play a role also in other sports disciplines such as swimming, where US-American and Australian swimmers dominated the 2000 Olympic Games (Trewin et al. 2004).

In contrast to single sports disciplines with a long tradition, multi-sports disciplines such as triathlon (Lepers 2008) and duathlon (Rüst et al. 2012; Sparks et al. 2005) are held since several years. In these races, athletes have to train and compete in different disciplines such as swimming, cycling and running. The most famous long-distance triathlon is the 'Ironman Hawaii' held since 1978 (Lepers 2008). However, little is known about the origin of multi-sports athletes. It has been shown that Europeans dominate participation and performance in long-distance triathlons such as the Double Iron ultra-triathlon distance covering 7.6 km swimming, 360 km cycling and 84.4 km running (Rüst et al. 2012b). Lepers et al. (2011) reported that 79% of ultra-triathletes having finished a Double Iron, a Triple Iron and a Deca Iron ultra-triathlon originated from Europe.

In contrast to triathlon where multi-sports athletes have to swim, cycle and run, duathletes complete first a run, then change to cycling and finish with a second run. While in long-distance triathlon the swim (3.8km), bike (180km) and run (42.2km) splits are worldwide the same, the run, bike, and run distances in the 'Powerman' duathlons differ between the races (www.powerman.org). In addition, duathlons can be held as a cross-country form with trail running, mountain biking and trail running (www.duathlon247.com). Long-distance duathlons are held as a 'World Series' in the 'Powerman World Series' (www.powerman.org). In addition, a World Championship in long-distance duathlon is held at the 'Powerman Zofingen' (www.powerman.ch).

For long-distance duathletes, the sex difference and the age-related changes in performance have been previously investigated (Rüst et al. 2012a). Considering the aspects of origin and nationality and their relation with endurance performance, the present study investigated participation and performance trends at the 'Powerman World Championship' in 'Powerman Zofingen' with a special emphasis regarding the nationality of the participants.

Materials and methods

The 'Powerman Zofingen' is one of the oldest and most famous long-distance duathlon in the World (www.powerman.ch) and is held as the official 'Powerman World Championship' (www.powerman.org). The 'Powerman Zofingen' exists since 1989 and the race course has been changed several times since its first edition. Since 2002, the race course remained unchanged as 'Powerman Zofingen', consisting of 10 km running, 150 km cycling and 30 km running. In contrast to 'Ironman Hawaii' (http://ironman.com/worldchampionship) where the field of starter is limited and athletes have to qualify for the race, 'Powerman Zofingen' has no limitations for athletes.

Sex and nationality at the time of competition and the running and cycling velocity as well as overall race time of both women and men finishers at the 'Powerman Zofingen' were analyzed from 2002 to 2011. The data set from this study was obtained from the race website (www.powerman.ch) and from the race director. This study was approved by the institutional review board of St. Gallen, Switzerland, with waiver of the requirement for informed consent given that the study involved the analysis of publicly available data. The study meets the ethical standards of the journal (Harriss and Atkinson 2011).

In total, data from 2,578 athletes, including 310 women and 2,268 men, were available for analysis. Of all participants, 38 women and 304 men did not finish the race and thus were excluded from analysis. Data from 272 women and 1,964 men could be included into data analyses. The athletes originated from 50 different countries from all over the world. To analyse the development in absolute performance, the five fastest overall women and men duathletes per year were determined, pooled and analysed. To analyse the development in total performance regarding aspects of nationality, race results from the five countries providing the highest number of the five fastest athletes were determined. These countries were Switzerland (SUI), Germany (GER), France (FRA), Italy (ITA) and Belgium (BEL). From these five athletes, overall race time was determined for every year and analysed. Due to the very low number of women per nation and year, only men could be included in this data analysis. The five countries provided a total of 183 women and 1,555 men, equivalent to 67.3% of all women and 79.2% of all men finishers.

Table 1. Percent distribution of the origin of women and men finishers expressed in mean ± SD.

Country	Women (%)	Men (%)
Switzerland	43.2±17.5	38.2±8.2
Germany	16.1±11.6	21.5±5.2
France	4.4±3.6	8.2±2.9
Belgium	2.4±3.1	5.8±2.4
Italy	1.6±2.9	6.0±2.1
Great Britain	4.7±3.7	1.5±0.9
United States of America	2.1±3.8	3.3±2.4
Austria	2.2±2.6	2.3±1.3
Spain	0.9±2.9	2.5±0.7
Others	22.3±5.9	10.6±2.1

Statistical Analyses

In order to increase the reliability of data analyses, each set of data was tested for normal distribution as well as for homogeneity of variances. Normal distribution was tested using a D'Agostino and Pearson omnibus normality test (D'Agostino et al. 1990) and homogeneity of variances was tested using a Levene's test. To investigate development of a variable across years, linear regression was used. To find differences between groups, a Mann-Whithney test was used. Statistical analyses were performed using IBM SPSS Statistics (Version 19, IBM SPSS, Chicago, IL, USA) and GraphPad Prism (Version 5, GraphPad Software, La Jolla, CA, USA). Significance was accepted at $P<0.05$ (two-sided for t-tests).

Results

Participation trends

Between 2002 and 2011, a total of 272 women and 1,964 men finished ''Powerman Zofingen'. The participation increased across years in women, but not in men (Figure 1). For both women and men, most of the athletes originated from Switzerland, followed by participants from Germany, France, Italy, Belgium, the United States of America, Spain, Great Britain, the Netherlands and Denmark (Figure 2). For the overall field, women and men from Switzerland represented ~38% and ~43% of the finishers, respectively. German athletes amounted to ~21% for men and ~16% for women (Table 1). Across the years, both women and men from Germany increased their participation regarding the five countries with the highest number of participants (Figure 3). Athletes from other countries

Table 2. Origin of the top five women and men athletes per year.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Women										
1	Switzerland	New Zealand	Hungary	Hungary	Hungary	Hungary	Hungary	Hungary	Hungary	New Zealand
2	Switzerland	Hungary	Great Britain	Great Britain	Great Britain	Sweden	Sweden	Great Britain	Switzerland	Sweden
3	Switzerland	Great Britain	Liechtenstein	Switzerland	Switzerland	Switzerland	Switzerland	Sweden	Sweden	Hungary
4	Denmark	Switzerland	Switzerland	Ukraine	Ukraine	Switzerland	Switzerland	Germany	Switzerland	Netherlands
5	Switzerland	Switzerland	Switzerland	Switzerland	Great Britain	Great Britain	Switzerland	New Zealand	New Zealand	Germany
Men										
1	Switzerland	Switzerland	Switzerland	Belgium	Belgium	Belgium	Switzerland	Belgium	France	Belgium
2	Switzerland	Belgium	Spain	Belgium	France	Denmark	France	Switzerland	Switzerland	France
3	Netherlands	Netherlands	Belgium	United States	Belgium	France	France	France	France	Switzerland
4	Spain	France	Spain	Belgium	Switzerland	Switzerland	Switzerland	France	Denmark	Switzerland
5	Germany	Sweden	Germany	Germany	Belgium	France	Switzerland	Austria	Denmark	Denmark

showed no changes in participation. For both German and Swiss athletes, the change in participation of athletes showed no association with the change of the general population in the corresponding countries (Figure 4).

Performance trends

Table 2 presents the nationalities of the top five athletes for both women and men from 2002 to 2011. In women, Hungarian athletes won seven races. In men, Belgian duathletes achieved five victories. During the studied period, the top five athletes for both women and men showed no changes in performance (Figure 5). Also, the athletes from the five countries with the highest participation showed no changes in overall race time (Figure 6). The fastest race times across years were achieved by Swiss duathletes.

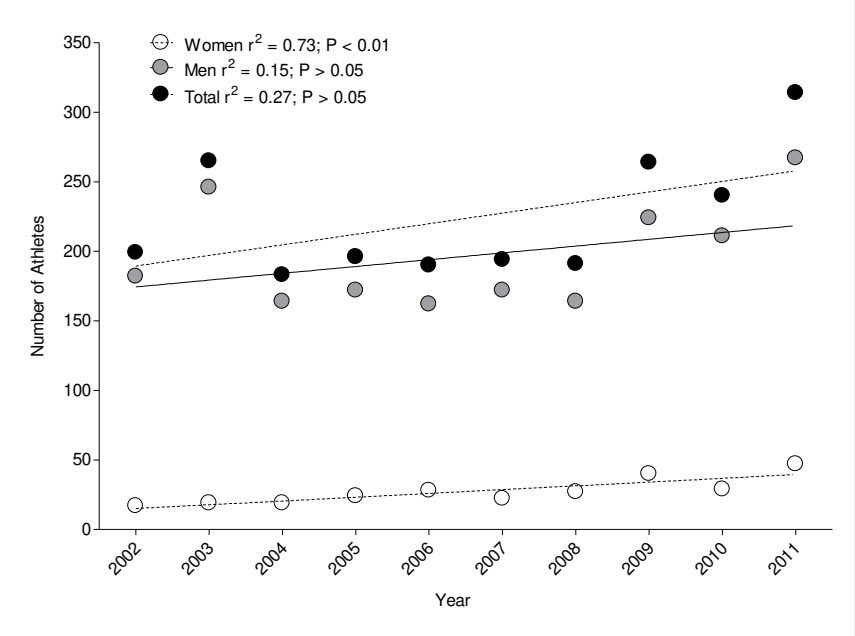

Figure 1. The number of women finishers, men finishers and total finishers per year.

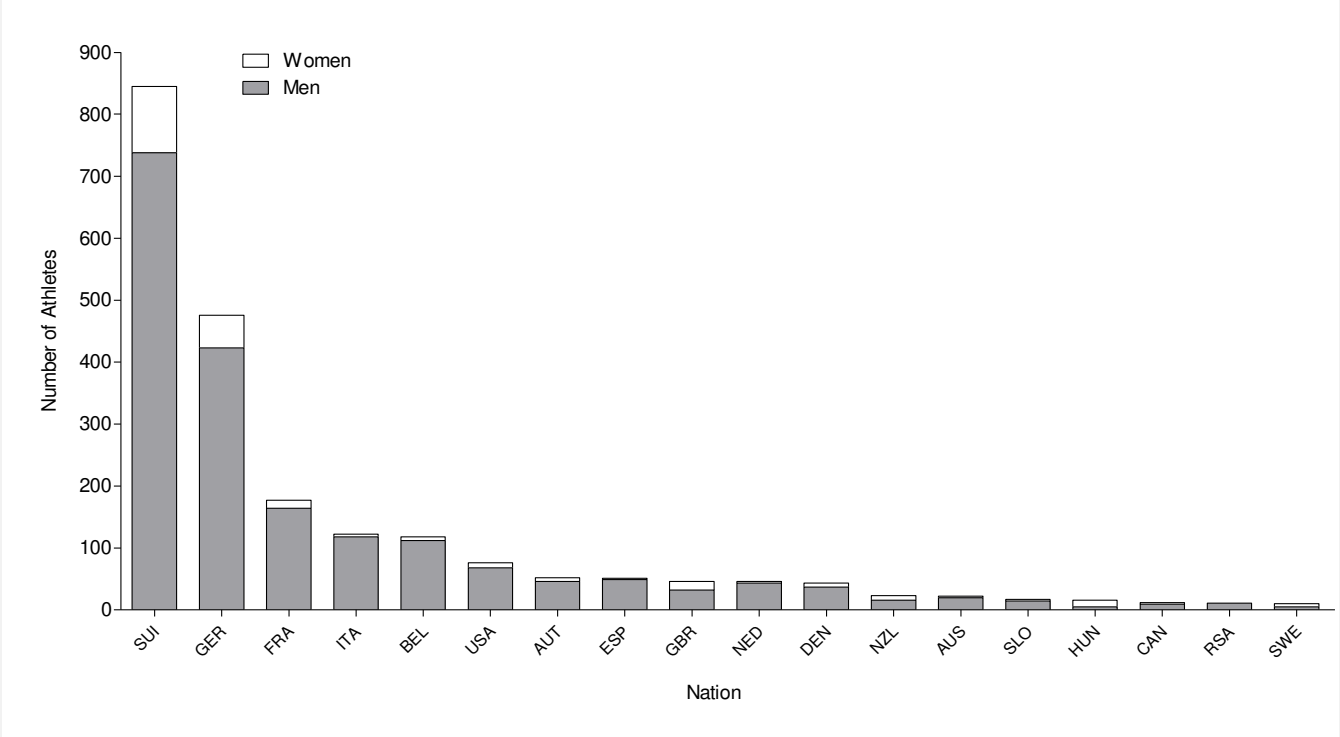

Figure 2. Number of women and men finishers per country.

Discussion

The aim of this study was to investigate the participation and performance trends at the 'Powerman Zofingen', the 'Powerman World Championship'. Most of the participants originated from European countries such as Switzerland, followed by athletes from Germany, France, Italy, Belgium, Austria, Spain, Great Britain and the Netherlands. Athletes from Switzerland and Germany represented the largest groups of athletes.

The high representation of European athletes at the 'Powerman World Championship' in Zofingen, Switzerland, is most probably due to the high popularity of duathlon in European countries. In 'Powerman Zofingen', any athlete can participate in the 'Powerman World Championship' without the need to qualify (www.powerman.org). In addition, the fact that Powerman duathletes do not need to qualify for the 'Powerman World Championship' may increase the field of European athletes of neighbouring countries to Switzerland. This regulation is in contrast to the qualification for the 'Ironman World Championship' held in 'Ironman Hawaii' (http://ironman.com/worldchampionship) where athletes all over the world need to qualify. So any athlete can start in 'Powerman Zofingen'. It does therefore not astonish that Switzerland as host country represents most of the athletes for both women and men.

The official 'Powerman World Series' (www.powerman.org) consists of ten races worldwide where eight races (Powerman Holland, Powerman Fuerteventura, Powerman Germany, Powerman Benny Vansteelant Memorial, Powerman Vlaanderen, Powerman Austria, Powerman Zofingen and Powerman Italy) are held in Europe. Only one race is held in the United States of America (Powerman Alabama) and another race outside of Europe is held in Asia (Powerman Malaysia). It is interesting, however, that German athletes ranked behind Swiss athletes as second nation in participation although Germany has an own 'Powerman Germany' (www.powerman-germany.org). In addition, German women and men duathletes increased their participation in 'Powerman Zofingen'. However, we found for both German and Swiss athletes no relationship with the change in general population in their countries although the general population increased in both Switzerland (www.bfs.admin.ch) and Germany (www.destatis.de) during the investigated period. So, the increase in participation of German athletes seems to be independent from the increase in the general population in Germany. Although Germany is near to Switzerland, also Holland, Belgium, and Austria are near to Germany. Most probably the 'Powerman World Championship' attracts as a World Championship itself the German athletes. Considering athletes from other countries, it is not astonishing that French athletes rank among the first nations regarding participation in 'Powerman Zofingen' since there is no Powerman duathlon race in France. However, also Italian, Belgian, American, Austrian, and Spanish athletes were among the ten nationalities with the highest participation, although they have their own 'Powerman' race in their country.

The rather low participation from athletes from the United States of America, New Zealand and Australia might be explained partially for American duathletes since they have 'Powerman Alabama' (www.team-

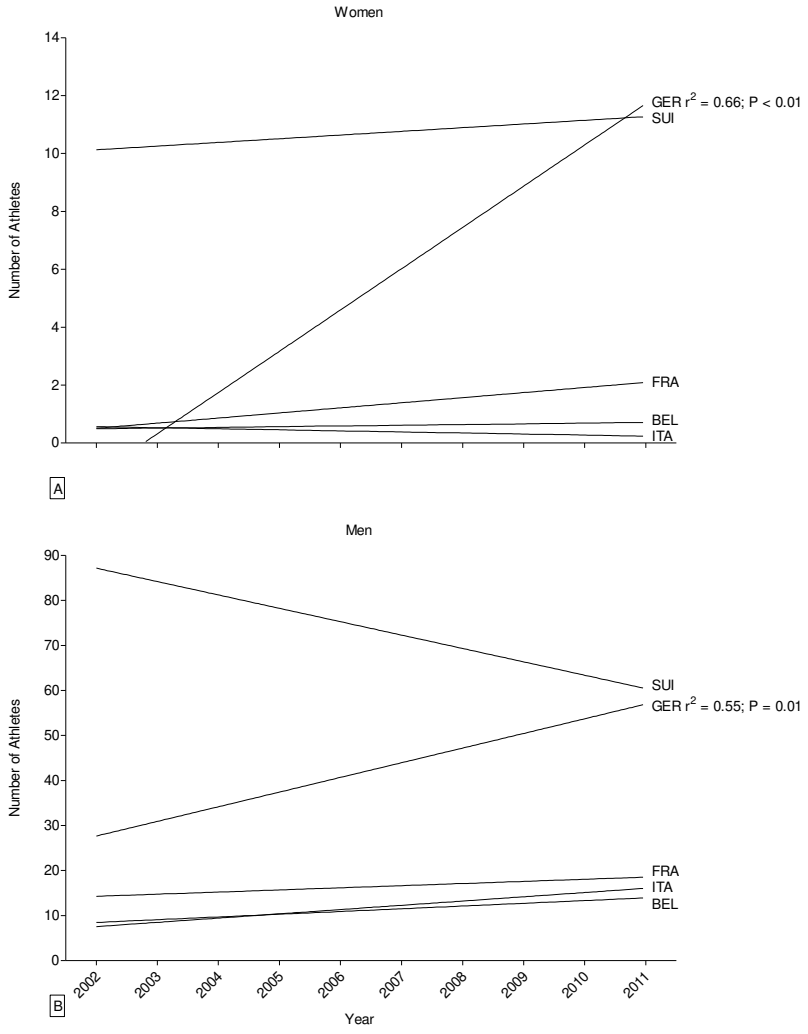

Figure 3. Development of the annual number of women (Panel A) and men (Panel B) finishers for the five countries with the total highest number of finishers.

magic.com/events/powerman). Athletes from New Zealand and Australia may start in Powerman races nearer to Oceania such as 'Powerman Malaysia' and 'Powerman Alabama'. Otherwise, multi-sports athletes from New Zealand and Australia preferably compete in Ironman triathlons such as 'Ironman New Zealand' (www.ironman.co.nz), 'Ironman Australia' (http://ironmanaustralia.com), 'Ironman Melbourne' (http://ironmanmelbourne.com), or 'Ironman Western Australia' (http://ironmanwesternaustralia.com). While the 'Powerman World Championship' is dominated primarily by European duathletes and partially by participants from the United States of America and Oceania, the participation of athletes from Asia is nearly missing. Athletes from Asia can compete in 'Powerman Malaysia' since 2002 (www.powerman.com.my). Most probably, Asian duathletes prefer to start in 'Powerman Malaysia' rather than to travel to Europe or to the United States of America. However, also Asian multi-sports athletes may rather compete in Ironman triathlons such as 'Ironman China' (http://ironmanchina.com).We need also to consider that athletes from America and Asia need to travel to Europe. It will cost an athlete from America or Australia several thousand Dollars to pay the costs of travelling, accommodation (www.priceline.com and the entry fee for the race (www.powerman.ch).

A further important finding was that neither the overall top five athletes nor the top five athletes of the most represented countries improved their overall race time. Similar findings were reported for the 'Ironman World Championship'. At the 'Ironman World Championship' for both sexes, overall race time decreased during the 1980s and tended to stabilize over the last two decades (Lepers 2008). Since we started our data analysis in 2002 due to

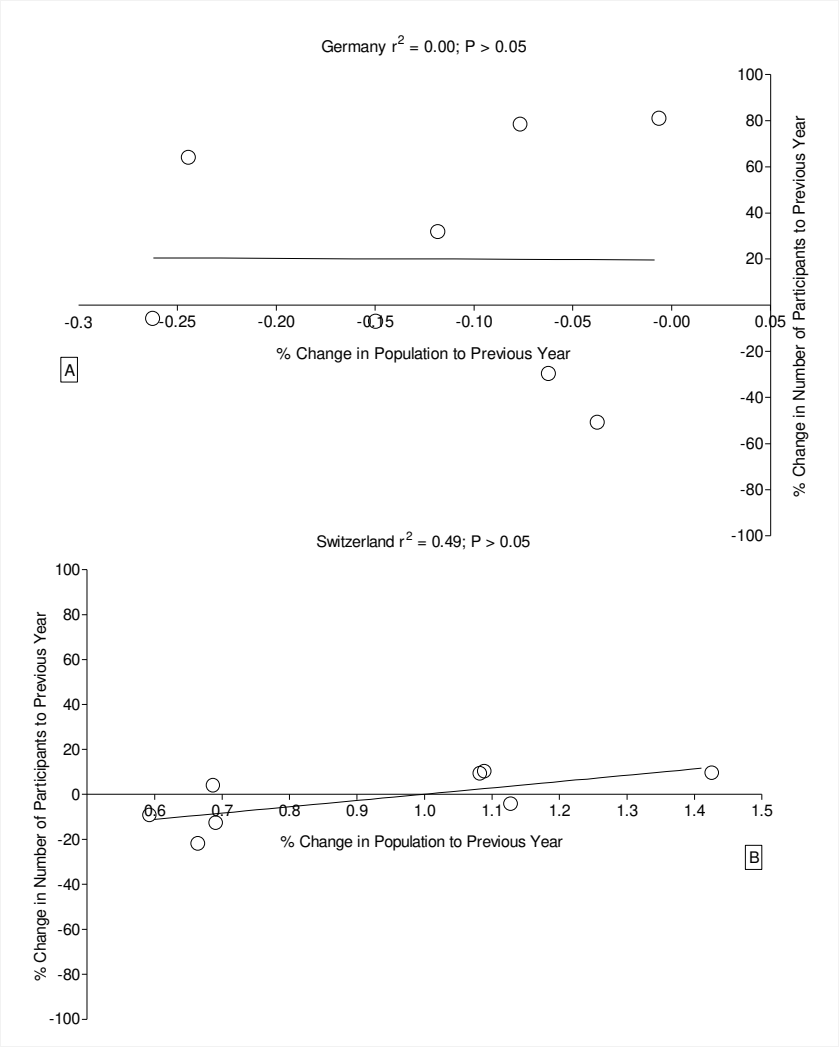

Figure 4. Percentage change in the number of finishers originating from GER (Panel A) and SUI (Panel B) related to the percentage change in the number of inhabitants in the respective country. Data from Germany were provided by Statistisches Bundesamt, Wiesbaden, Germany (www.destatis.de) and data from Switzerland by Bundesamt für Statistik, Bern, Switzerland (www.bfs.admin.ch).

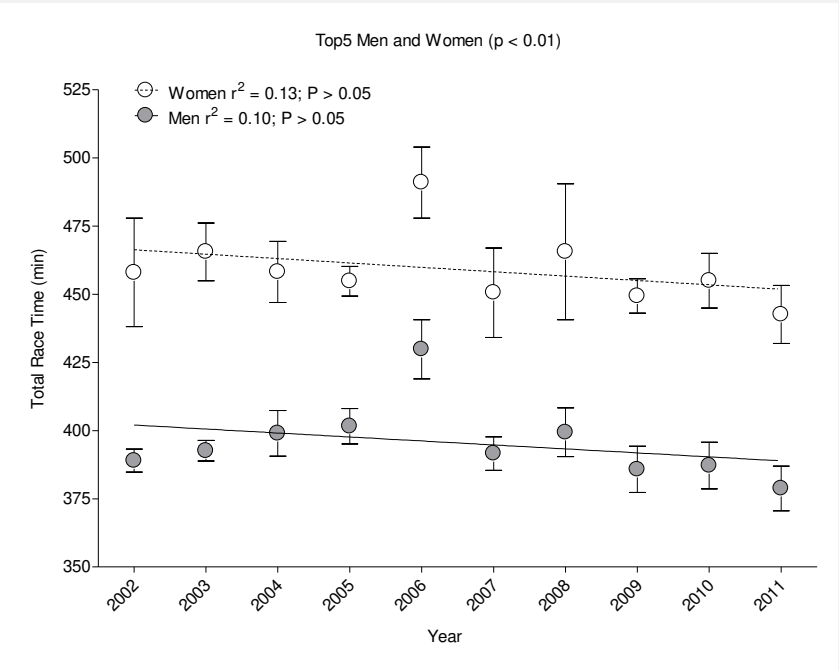

Figure 5. Race time for the top five women and men finishers per year.

several changes in the race circuit in previous years, the stability of performance of the top athletes is not surprising. Also in longer distances than the Ironman triathlon, no changes in performance were reported for Double Iron ultra-triathlon, Triple Iron ultra-triathlon and Deca Iron ultra-triathlon across years (Knechtle et al. 2011a). A potential explanation could be that athletes entering in ultra-endurance races achieved already a broad experience in their career (Herbst et al. 2011; Knechtle et al. 2011b, 2011c) and compete also in ultra-distances at a high level. Although Swiss duathletes achieved the fastest race times across years, athletes from other countries such as Hungary, Belgium, New Zealand and France were more successful regarding winning the race. In women, Hungarian athletes won seven races and in men, Belgian duathletes achieved five victories. We assume that the top duathletes start in the 'Powerman World Championship' and Swiss duathletes have a wide basis for top performances, but were not the overall fastest in the last years.

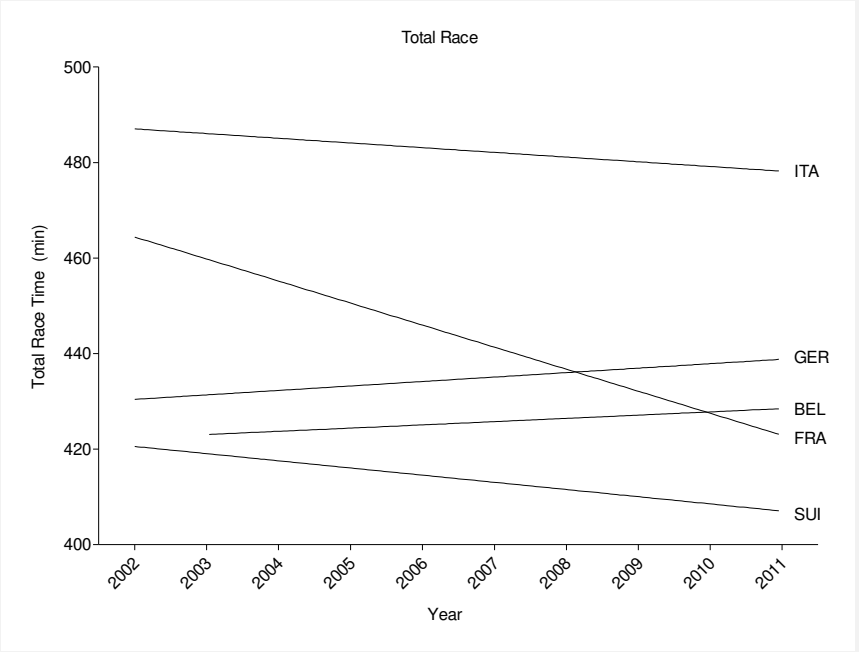

Figure 6. Race time for the top five men per year originating from the five countries with the highest number of total finishers.

This study is limited since variables such as age (Knechtle et al. 2011d; Lepers et al. 2012; Rüst et al. 2012a), anthropometric characteristics (Knechtle et al. 2011e), training (Knechtle et al. 2010a) , and previous experience (Knechtle et al. 2010b; 2011b; 2011c) with an effect on ultra-endurance performance in multi-sports athletes were not included. In addition, environmental conditions (Parise and Hoffman 2011; Wegelin and Hoffman 2011; Rüst et al. 2012a) across the years might have an influence on race times in ultra-endurance athletes.

Conclusion

To summarize, European athletes dominated the 'Powerman World Championship' in Zofingen, Switzerland, regarding participation most probably due to the central location of Switzerland in Europe. Considering performance, Swiss duathletes achieved the fastest race times across years. The central location in Europe and the fact that athletes do not need to qualify for the 'Powerman World Championship' most probably explains the findings for both participation and performance. The take-home messages of this study are (i) European athletes from Switzerland and Germany dominated participation in the 'Powerman World Championship' where Swiss duathletes were the fastest and (ii) elite duathletes showed no changes in performance during the last decade in the 'Powerman World Championship'. Future studies should investigate the participation and performance trends in other long distance duathlon of the 'Powerman World Series'. In addition, the participation and performance trends for triathletes worldwide should be investigated in both the 'Ironman World Series' and in the 'Ironman World Championship' in 'Ironman Hawaii'.

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